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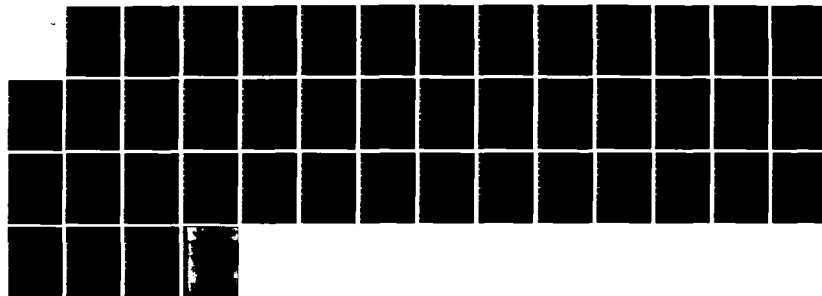
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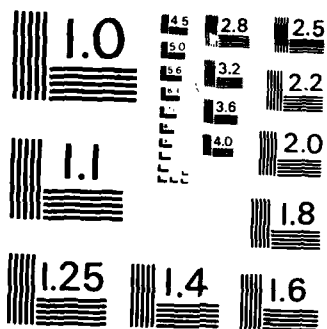
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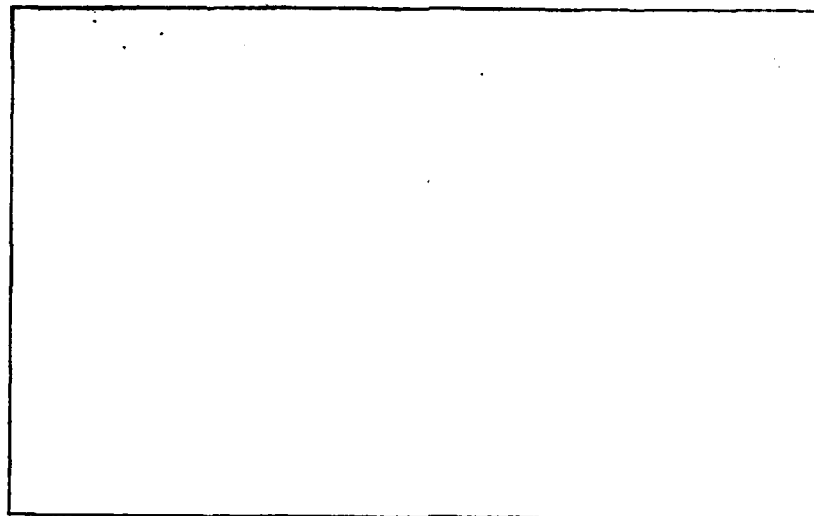
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Because unit operations processing differs from one category to another, each is reviewed separately. For each category a description is given of the current WSSC procedures, including input data selection and algorithms. This description is followed by an evaluation which addresses the face validity of these procedures.

Desmatics makes several specific recommendations for changes in WSSC processing, and raises several questions for review by Office of VAMOSC personnel. Desmatics' conclusions and recommendations are listed in this report, together with accompanying comments from the Office of VAMOSC.

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# DESMATICS, INC.

P. O. Box 618

State College, PA. 16801

Phone: (814) 238-9621

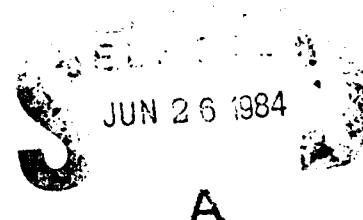
*Applied Research in Statistics - Mathematics - Operations Research*

AN EVALUATION OF THE WSSC  
COST ALLOCATION ALGORITHMS  
III: UNIT OPERATIONS

by

Robert L. Gardner  
Karen L. Evans  
Dennis E. Smith

TECHNICAL REPORT NO. 115-4



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for public release and sale; its  
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Prepared under Contract No. F33600-80-C-0554

## EXECUTIVE SUMMARY

This report by Desmatics, Inc. is the third in a series of volumes which review procedures used by the Weapon System Support Cost (WSSC) subsystem of VAMOSC to allocate operating and support costs to Air Force weapon systems. This volume presents the results of an examination of algorithms and data used by WSSC to allocate unit operations costs.

Because unit operations processing differs from one category to another, each is reviewed separately. For each category a description is given of the current WSSC procedures, including input data selection and algorithms. This description is followed by a qualitative evaluation which addresses the face validity of these procedures.

In general, data availability poses the greatest difficulty for unit operations processing. Because cost and/or strength data is not available at an appropriate level of detail, estimates must be made using crew tables, security tables and munitions cost factors. Reliance on such factors obscures inherent variability in costs and strength needs that arise from characteristic differences among bases, commands and missions.

With a few exceptions, WSSC makes the best possible use of the limited available data by means of its allocation algorithms. Aircrew, POL and training munitions algorithms are sound. Desmatics recommends changes to the remaining categories, however. For reasons described more fully in the report, it is suggested that (1) command staff and other personnel costs and strengths should be allocated to MDS's on the basis of relative aircrew strengths and (2) security costs and strengths should be allocated on the basis of possessed hours only.

Desmatics has determined that, in general, WSSC procedures satisfy

CAIG requirements for unit operations cost visibility. A specific change that is recommended, however, is for WSSC to include oil and lubricant costs in unit level consumption as specified by CAIG. Manpower and gallon usage data, which is desired by CAIG, is currently not displayed in the CAIG report, although manpower data is displayed in the USAF Detail report.

A few minor problems were observed in WSSC data selection and classification. Discussion of the specific problems and suggestions for possible solutions are given in the report.

In summary, Desmatics makes several specific recommendations for changes in WSSC processing, and raises several questions for review by Office of VAMOSC personnel. Desmatics' conclusions and recommendations are listed in this report, together with accompanying comments from the Office of VAMOSC.



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## I. INTRODUCTION

Desmatics, Inc. under Contract No. F33600-80-C-0554, is conducting an evaluation of the cost allocation algorithms employed in the Weapon System Support Cost (WSSC) subsystem of VAMOSC, the Air Force Visibility and Management of Operating and Support Costs system. This report is the third in a set of volumes which discuss the scope and findings of the Desmatics evaluation effort.

The purpose of this volume is to evaluate the WSSC procedures for allocating unit operations costs to Air Force aircraft weapon systems. As discussed in Volume I [2], this report is restricted to a qualitative examination which evaluates the face validity of WSSC system logic. It examines the reasonableness of the procedures used for selecting, classifying, and allocating unit operations costs to weapon systems, assessing whether they may be expected to provide equitable results. A quantitative evaluation to determine mathematical validity will follow in Volume VII when the required data has been collected and analyzed.

Based on its research, Desmatics has made a number of specific recommendations which are enumerated in Section VIII of this report. The corresponding responses and comments of the Office of VAMOSC accompany each recommendation.

The Statement of Work under which this Desmatics study was initiated calls for the evaluation of the WSSC system algorithms as set forth in system specifications dated June 1980. The WSSC system has evolved almost continually since that time, reflecting improvements that were made in virtually every aspect of the system logic prior to the first production runs in April 1982. Additional modifications and enhancements were made to

WSSC between the first production run in 1982 and the second run made in April 1983, and more are planned for the immediate future.

Desmatics recognizes that to restrict its evaluation to the June 1980 baseline would significantly limit the usefulness of its findings. Accordingly, Desmatics has kept pace with the evolution of the WSSC system, and has attempted to reflect the significant system changes in its study, specifically in those instances where a given cost was computed by different algorithms in two (or more) years. As a result, the documentation of Desmatics' findings is more complex than might otherwise be the case. The reader may expect frequent encounters with the phrases "for FY81," "for FY82" and "for FY83."

Desmatics has endeavored to have this volume reflect the current status of unit operations cost allocation algorithms within the WSSC system. The authors feel that this has been accomplished. However, the reader must realize that should future WSSC system changes impact on the algorithms discussed, portions of this report may become outdated.

## II. BACKGROUND

Unit operations, as defined by WSSC, consists of six major subcategories: aircrew, command staff, security, POL, training munitions and other unit activity. These subcategories, used in the USAF Detail report, correspond approximately with those O&S cost elements defined in the CAIG Aircraft Operating and Support Cost Development Guide [1] as unit mission personnel and part of unit level consumption.

In most cases the WSSC and VAMOH systems are unable to determine unit operations costs by MDS directly from the available cost data and must therefore allocate costs to MDS's (or to CMD/GELOC/MDS in the case of POL) on some basis. The processes used to select, classify and allocate unit operations costs are described in three WSSC source documents: (1) the WSSC User's Manual (AFR 400-31, Vol. II) [5], (2) the WSSC System/Subsystem Specification [3], and (3) the VAMOH System/Subsystem Specification [4].

Unit operations processing differs sufficiently from one category to another to justify discussing each in separate sections of this report. Each section presents a process description, an evaluation of the face validity of the algorithm, and a review of the appropriateness of the input sources.

### III. AIRCREW

There are two types of costs displayed within the aircrew category of unit operations, as depicted in the WSSC USAF Detail report and the CAIG Format report. These are officer pay and allowances and airman pay and allowances. In addition, counts of officer and airman aircrew personnel are presented in the USAF Detail report.

CAIG (the Cost Analysis Improvement Group) defines aircrew costs to consist of pay and allowances for the full complement of crews required to operate the aircraft of a unit, including crews needed to meet combat readiness, training and such administrative requirements as leave, temporary duty and sickness [1]. Flight pay differentials are also included in aircrew costs.

#### A. PROCESS DESCRIPTION

Although the H069R ABDS system contains cost data for aircrew personnel assigned to aircraft mission squadrons and flying training squadrons, WSSC does not use this data as the source for crew costs because these ABDS accounts also contain costs for the command staff personnel associated with flying squadrons. WSSC instead identifies crew personnel within the files of the E300Z Advanced Personnel Data System and computes pay and allowance costs for them by means of pay tables.

Crew personnel are defined in WSSC as those persons on flying status who have a Duty Air Force Specialty Code (DAFSC) authorized for one of the relevant command aircraft assigned to the base. For each command/base, crew members are identified in the personnel system records by the presence of Functional Account Code (FAC) 31XX (aircraft mission squadron) or 37XX

(flying training squadron), combined with a DAFSC which matches one of the DAFSC's in a table of authorized aircrew personnel. Officer aircrew records must also have an aircrew rated position code in the rated position identifier field of the personnel record. All the personnel thus identified within each command/base are counted and costed as crew personnel, but since there is no MDS identification information in the E300Z files, it is sometimes necessary to allocate them to specific MDS's by other means.

A separate calculation is made for each CMD/GELOC/MDS/DAFSC using data from an authorized crew table, which specifies the number of aircrew personnel, by DAFSC, authorized for each MDS within each relevant major command. Possessed hour data from the G033B system is used to determine the number of aircraft, by MDS and GELOC, within relevant commands. The authorized crew table and the number of aircraft are used to establish the total number of aircrew positions, by DAFSC, authorized for all relevant command aircraft at each base.

Pay and allowances for crew personnel are determined by applying average cost factors from pay tables. Crew personnel pay is computed using a composite pay factor (covering pay and allowances) and a flight pay factor, by grade. The resulting sum is applied to the personnel counts identified by MDS through the process described below.

In many instances, each DAFSC is unique to one MDS at a command/base, eliminating the need for allocation. However, in some situations a DAFSC may be common to two or more MDS's at a command/base. In such cases crew personnel with that DAFSC are allocated among those MDS's in proportion to the number that are required (according to the authorized crew table) to man all such MDS's for that command/base.

Thus, if there are 160 F4 pilots at a TAC base which had 25 F4E's

and 75 F4E's, each requiring one pilot, then 25% of these pilots would be allocated to the F4D's and the remainder to the F4E's. Similarly, a SAC base having 105 B52 pilots for 15 B52G's and 30 B52H's, each requiring two pilots, one third of the pilots would be allocated to the B52G's and the remainder to the B52H's. The other crew members for these aircraft are allocated in a similar manner, each DAFSC being treated separately.

#### B. QUALITATIVE EVALUATION

The techniques used by WSSC to determine the number of aircrew personnel and to calculate the costs for aircrew pay and allowances are judged by Desmatics to be sound in concept. DAFSC's are generally unique to an MDS, providing a fairly straightforward method for allocating aircrew personnel to an MDS in the majority of situations. Even in those infrequent cases where two or more MDS's at a base have a DAFSC in common, Desmatics believes that the method used by WSSC provides a valid and equitable basis for allocation. In these instances the aircraft differences are usually slight, being for the most part differences in series between two aircraft with the same mission and design, or possibly differences in modified mission. Lacking other information indicating how crew personnel are assigned, the WSSC assumption that crews are assigned among MDS's at a base in proportion to the number of aircraft is reasonable. Based on this assumption, crew costs should be allocated in the same manner.

The WSSC method for allocating crew personnel and crew costs to MDS's is equivalent to employing a flying operations ratio which uses a weighting coefficient such that only possessed hours are considered and flying hours have no contribution to the ratio. (Flying operations ratios are

discussed at some length in Section IV of Volume I [2].) Desmatics will conduct sensitivity studies using real WSSC data to assess the effects of varying the weighting factor used in various WSSC applications of flying operations ratios, including aircrew allocation. The results of this sensitivity study, to be reported in Volume VII, will provide further evaluation of the basis for aircrew allocation by indicating whether the use of flying hour data would have a significant effect on the allocated costs.

Desmatics judges that the use of pay tables is a satisfactory method for computing crew costs. It provides a means to include allowances which are not currently reflected in pay data obtainable from the ABDS files.



#### IV. COMMAND STAFF AND OTHER UNIT PERSONNEL

WSSC provides cost and manpower data for command staff and other personnel associated with aircraft operations, and displays separate line items for each in the USAF Detail format. These two types of personnel and their associated materiel, pay and other costs are distinguished on the basis of specific RC/CC codes. However, since the procedures used to allocate these costs to MDS's is the same for both categories, the algorithms and processes will be described and evaluated together.

Command staff personnel comprise those necessary to provide command, flying supervision, operations control, planning, scheduling, flight safety, aircrew quality control and unit administration. These functions are referred to by CAIG [1] as unit staff. Other unit personnel consist of those staff elements within flying organizations required for public information, ground safety, life support and such special mission functions as photo development and interpretation. CAIG refers to these as remaining unit personnel.

##### A. PROCESS DESCRIPTION

For FY81 command staff and other unit personnel were identified in the E300Z data files on the basis of the FAC codes shown in the left side of Table 1. Costs associated with their activities are identified within ABDS data files on the basis of the RC/CC codes and EEIC's given in Tables 2 and 3, respectively. These costs and personnel counts were then distributed among specific aircraft weapon systems using flying operations ratios computed on the basis of flying hour and possessed hour data obtained for each MDS from the AVISURS system.

FY81

FY82

<u>FAC</u>	<u>Personnel</u>	<u>FAC</u>	<u>Personnel</u>
13XX	Operations Staff (except 1311)	13XX	Operations Staff (except 1311)
31XX	Aircraft Mission Squadron (except crew)	31XX	Aircraft Mission Squadron (except crew)
37XX	Flying Training Squadron (except crew)	37XX	Flying Training Squadron (except crew)
		4724	Centralized Life Support
32XX	Audio-Visual	3280	Armament Recording System Support
33XX	Cartographic		
4724	Centralized Life Support		

Command Staff

Other Unit Personnel

Table 1: FAC Codes Used to Identify Command Staff and Other Unit Personnel  
(Code descriptions based on AFM 300-4, Vol. 1, ADE FU-500 [8].)

Command Staff Other Unit Personnel

<u>FY81</u>		<u>FY82</u>	
<u>RC/CC</u>	<u>Cost Center</u>	<u>RC/CC</u>	<u>Cost Center</u>
XX13XX	Operations Staff (except 1311 & 1312)	XX13XX	Operations Staff (except 1311 & 1312)
XX30XX	Aircraft Mission Squadron	XX30XX	Aircraft Mission Squadron
XX37XX	Flying Training Squadron	XX37XX	Flying Training Squadron
XX32XX	Audio-Visual	XX3280	Armament Recording System Support
XX33XX	ACI Squadron		

Table 2: RC/CC Codes Used to Identify Costs for Command Staff and Other Unit Personnel  
(Code descriptions based on AFR 170-5 [6].)

INCLUDED COSTS

<u>Cost Element</u>	<u>FY81</u>	<u>FY82</u>
Officer P&A	EEIC 20101	Pay table
Airman P&A	EEIC 20102	Pay table
Civilian P&A	EEIC 391XX-394XX, 396XX	EEIC 391XX-394XX, 396XX
Materiel	EEIC 60XXX-63XXX	EEIC 60XXX-63XXX
All other costs	Remaining EEIC's	Other EEIC's (except 20101, 20102)

EXCLUDED COSTS

<u>EEIC</u>	<u>Cost Element</u>
601XX	Aviation POL
602XX	Packaged Aviation Oils
603XX	Missile Propellants
6X4XX	Medical-Dental Materiel

Table 3: Classification of Command Staff and Other Unit Costs  
(Code descriptions based on AFM 300-4, Vol. I,  
ADE EL-191 [7].)

With respect to FY81 personnel costs, WSSC treated all of the operations personnel (RC/CC XX13XX except XX1311 and XX1312) as command staff personnel costs, but treated only a portion of the mission (RC/CC XX30XX) and flying training squadron (RC/CC XX37XX) personnel costs as command staff costs. This was accomplished by subtracting the crew costs computed in the aircrew process, described in Section III of this report. The rationale is that the personnel costs reported in ABDS for mission and flying training squadrons represent a combination of both aircrew and command staff personnel costs which could not be distinguished within ABDS data alone. WSSC therefore identifies crew personnel within the E300Z system files and computes costs using pay tables. To get FY81 command staff personnel costs, WSSC subtracted the table-computed crew costs from the FY81 ABDS personnel costs for mission and flying training squadrons. The difference was considered to represent command staff personnel costs within these squadrons and was added to the operations personnel costs to get the total command staff costs for personnel.

Starting in FY82, WSSC computed all military personnel pay and allowed using pay tables. This eliminates the need to subtract pay costs from ABDS data, since personnel costs are no longer obtained from ABDS.

The cost information selected from ABDS files using RC/CC codes is then distributed into pay, materiel and other expense categories on the basis of EEIC codes shown in Table 3. This table not only indicates the groups of codes to be included, but also provides a list of specific codes to be excluded.

For FY81 and FY82, each of the included types of command staff and other unit personnel and the associated costs, as defined above, was separately allocated among the relevant command aircraft at each command/

base using a special allocation ratio (AR) for each CMD/GELOC/MDS, based on flying hour and possessed hour data from the G033B (AVISURS) system. The ratio is:

$$AR = 0.5 \left[ \frac{FH(CMD/GELOC/MDS)}{FH(CMD/GELOC)} + \frac{PH(CMD/GELOC/MDS)}{PH(CMD/GELOC)} \right] .$$

For FY83, the Office of VAMOSC is considering allocating command staff and other unit personnel strengths to MDS's in proportion to crew strengths. Costs would be allocated proportionally to crew pay dollars.

#### B. QUALITATIVE EVALUATION

The WSSC definitions of command staff and other unit personnel correspond satisfactorily with those provided in the CAIG guide. However, the specific code structure used to select these personnel from the E300Z files and to select the corresponding costs from the H069R files warrants some discussion. The basis for allocation of these administrative personnel and costs to weapon systems also merits consideration.

As the means of identifying costs associated with command staff and other unit personnel, WSSC ostensibly uses RC/CC codes. In reality, however, WSSC ignores the responsibility center (RC) code portion entirely and, with a few exceptions, utilizes only the first two positions of the cost center (CC) code. In most cases this works satisfactorily. However, there are certain instances where the RC code could be used to considerable advantage to exclude costs which do not appear to be mission related. These are associated with higher level (above wing) organizations, certain independent organizations resident at air bases which are not aircraft mission-oriented, and costs incurred on behalf of Air National Guard and

Air Force Reserve units. Each of these will be discussed briefly in the following paragraphs.

The CAIG guide calls for the exclusion of costs associated with headquarters and staff activities at the level of Air Division and above. These levels of command can be identified on the basis of specific RC codes, at least within MAC, SAC and TAC (the major commands whose supplements to AFR 170-5 have been examined by Desmatics), and should be excluded. The specific codes required to make these exclusions vary among commands, but it appears possible to build a table of command and RC code combinations to accomplish the required exclusions. (However, this technique can only be applied to costs which WSSC obtains from ABDS directly. Pay costs computed from pay tables cannot be handled in this manner, since no equivalent to the RC code is available in the FAC code for identifying higher echelon personnel. While the Personnel Accounting Symbol (PAS) might be used, a very large table would have to be constructed.)

In a similar fashion, certain costs associated with Air National Guard and Air Force Reserve (ANG/AFR) units, but reported in ABDS data by relevant commands, can be identified on the basis of specific RC codes. If the RC codes for ANG/AFR are ignored, these costs will be charged against mission aircraft. However, they do not appear to be legitimate marginal costs associated with the regular mission aircraft of relevant command bases. Thus, the most appropriate way to treat ANG/AFR-related costs would be to exclude them from WSSC processing, using the appropriate RC codes within each relevant command as the basis for exclusion. An alternative would be to treat ANG and AFR as additional relevant commands and include ANG/AFR-coded ABDS costs from the present seven relevant commands. However, other considerations, such as data quality and availability limitations, might

weigh heavily against this course of action.

The ANG/AFR picture is further complicated by the existence in MAC of the associate program, under which active Air Force aircraft are flown by ANG/AFR personnel on a part-time basis. In addition, ANG/AFR personnel also perform maintenance of these aircraft under the associate program. The effect of this program on WSSC data is not obvious, and the extent and direction of its possible impact could not be determined without further investigation beyond the scope of the current study.

There are other RC codes that appear to represent types of costs which should be excluded from WSSC processing, on the grounds that they are not directly associated with the activities of the mission aircraft at the bases where the costs are incurred. These primarily originate in independent organizations which are resident at air bases. Some of these represent host-funded tenant BOS costs which can be identified on the basis of 9-series RC codes, as defined in AFR 170-5. If the RC code is ignored, some of the costs will be treated by WSSC as command staff on the basis of their CC codes, while others will be treated as BOS on the basis of their PEC codes. Other types of non-mission related independent organizations are command-unique and can be identified by RC codes assigned by the reporting command. It is recommended that the AFR 170-5 supplements for the relevant commands be reviewed by the Office of VAMOSC to determine whether these costs should be excluded from WSSC processing.

Another possible discrepancy was noted by Desmatics with respect to one group of "other unit personnel" and their associated costs. The original WSSC specifications included RC/CC XX33XX costs and FAC 33XX personnel in "other unit personnel." AFR 170-5 defines RC/CC XX33XX as ACI squadrons and detachments, and indicates that the related FAC is 33XX. ACI is not



defined in AFR 170-5, but AFM 300-4 (FU-500) indicates that FAC 33XX relates to cartography. Following FY81 processing, the Office of VAMOSC determined that these codes are not used by the Air Force and so they are no longer part of WSSC selection criteria.

It should be noted also that the USAF Detail format for command staff and other unit costs shows no display of contract costs for either of these two categories. The specifications describing the EEIC structure used by WSSC indicates that contract costs are identifiable on the basis of EEIC's, and a survey of FY81 data indicates that contract costs are incurred in operations cost centers. However, according to the WSSC specifications, such contract costs are not separately displayed, but instead are included in the "other" category. It is recommended that contract costs be separately displayed rather than being lumped with other miscellaneous costs.

There were two specific problems with respect to the treatment of life support personnel and costs. For FY81, life support personnel were defined by WSSC as those reported in the E300Z files with a FAC of 4724 (centralized life support), and were classified by WSSC as other unit personnel. However, the costs for this function, according to AFR 170-5, are found under RC/CC XX3000, and were treated by WSSC as command staff costs in FY81. Thus, the personnel and the costs for this function were displayed by WSSC under two separate headings. It would be preferable to classify both within the same category.

A second problem is that FAC 31XX may also include life support personnel, namely FAC 3102, defined as including "all activities related to unit aircrew life support operations where the service unit has a deployment requirement restricted to squadron level." Thus for FY81 the FAC 3102 unit life support personnel were treated as command staff, while centralized life

support personnel in FAC 4724 were treated as other unit personnel.

Desmatics suggested that the easiest way to achieve consistency is to treat the FAC 4724 centralized life support personnel as command staff rather than "other unit personnel." This change was made for FY82, so that now all life support personnel and costs are displayed in the same category.

As previously indicated, command staff and other unit personnel costs, once identified by code structure and selected for inclusion, are each pooled within CMD/GELOC. All of these costs are then allocated among the relevant command aircraft at each base, employing a flying operations ratio which is based on possessed hour and flying hour data obtained from the AVISURS system. This ratio has the inherent defect of being "inconsistent," as discussed in Volume I [2]. Even if this problem did not exist, however, an allocation approach more in line with standard cost accounting practices could be used.

Unit operations activities are perhaps most analogous in a typical manufacturing operation to a production division. Aircrew pay and allowances are equivalent to direct labor, while POL and training munitions costs correspond to direct materials. Command staff and other unit personnel correspond to departmental administration. Thus, the costs associated with command staff/other unit personnel functions represent administrative overhead. In the usual manufacturing operation, direct labor hours or direct labor costs would be selected as the basis for allocating the corresponding overhead expenses to different products. It would seem reasonable for WSSC to adopt a similar approach.

The use of either direct labor hours (number of aircrew personnel) or direct labor costs (aircrew pay and allowances) for allocation would pose no difficulties in implementation, since the necessary data is readily

available in WSSC. Although either basis of allocation could be chosen, Desmatics recommends that number of aircrew personnel be selected, under the assumption that the command staff and other unit personnel functions are more directly related to number of people than to the corresponding costs. The algorithm suggested for incorporating this type of allocation into WSSC would be based on the ratio:

$$\frac{\text{Aircrew Strength (CMD/GELOC/MDS)}}{\text{Aircrew Strength (CMD/GELOC)}} .$$

All command staff and other unit personnel costs, i.e., pay and allowances, materiel, and other (as well as contract), would be allocated to MDS's at each CMD/GELOC by use of this ratio.

Desmatics undertook to determine whether the personnel data for FY81 would provide support for the contention that staff personnel should be allocated to MDS's in proportion to crew strengths. Fourteen program element codes (PEC) were identified in AFR 300-4 which have unique MDS associations (e.g., PEC 11113 is B52, 11142 is KC135 and 41119 is C5A). Using a preliminary sample of personnel from a few bases, Desmatics attempted to determine whether the staff personnel were distributed among MDS-unique PEC's in the same approximate ratios as the crew personnel were distributed within the same PEC's. While some of the findings tended to support the proposition, the results are only tentative and indicate the need for further investigation, which is in progress. A discussion of this investigation will be included in Volume VII.

Earlier in this section it was pointed out that costs associated with organizational elements above the wing level can be identified on the basis of the first two positions of the RC/CC code. This provides a method for excluding higher echelon costs. There is a similar problem with personnel data, but the means of excluding higher echelon personnel is less direct.

Currently the personnel data received by WSSC from the E300Z system includes certain above-wing personnel who should not be counted. Whereas the corresponding costs in the ABDS file can be identified by means of the responsibility center code, the FAC codes do not provide similar identification. It is unlikely that the FAC codes themselves can be used to exclude higher echelon personnel without also excluding wing and squadron personnel. While it might be possible to compute ratios of higher echelon costs (e.g., the ABDS-reported pay costs in RC/CC XX13XX for above wing, relative to the same costs for wing level and below), it would be invalid to reduce the personnel counts by the same proportion across the board, because the distribution of personnel by grade would differ in an unpredictable way.

An alternative approach would be to identify higher echelon organizations by Personnel Accounting Symbol (PAS) codes and exclude all personnel in these PAS groups from the MPC input to WSSC. Desmatics intends to investigate the feasibility of this approach in the future and report its findings in Volume VII. The problem is of increasing concern, since WSSC has placed greater emphasis on the use of pay tables to compute costs for pay and allowances.

## V. AIRCRAFT SYSTEM SECURITY

WSSC displays as a separate line item the costs for personnel needed to provide system security for aircraft weapon systems, where required. Work load distributions are also displayed for this function. CAIG guidelines define system security to include security forces and administrative personnel needed to perform required entry control, close and distant boundary support, and alert team functions.

### A. PROCESS DESCRIPTION

WSSC determines costs for system security by identifying the personnel at each base assigned to this activity. Such personnel are identified in the E300Z personnel system as having a FAC of 435X, and are costed using pay tables. These security personnel costs are summarized by CMD/GELOC and are allocated among those relevant command aircraft which require security, using a security allocation ratio which for FY81 was based on possessed hour and flying hour data from the AVISURS system. For FY82 this ratio was changed to be based solely on possessed hours.

Each relevant command provides a table listing all MDS's which require system security. Using this table and a file of AVISURS data from the G033B system, WSSC builds a file of flying hours and possessed hours for all security-requiring aircraft. WSSC uses this information to compute a special allocation ratio (AR) for each security-requiring MDS within each CMD/GELOC, as follows:

$$AR = 0.5 \left[ \frac{FH(CMD/GELOC/MDS)}{FH(CMD/GELOC)} + \frac{PH(CMD/GELOC/MDS)}{PH(CMD/GELOC)} \right] \quad (\text{for FY81}),$$

or

$$AR = \frac{PH(CMD/GELOC/MDS)}{PH(CMD/GELOC)} \quad (\text{for FY82}).$$

The data used in this ratio is based only on those aircraft MDS's which require system security. The ratio is then applied separately to the counts of the system security personnel within each CMD/GELOC and to the associated costs computed through the use of pay tables. Separate totals are maintained for officer, airman and civilian personnel. In FY81 relevant commands were allocated all of the security costs. In FY82 these costs were allocated to all commands.

#### B. QUALITATIVE EVALUATION

The WSSC User's Manual (AFR 400-31, Vol. II) presents a number of assumptions and constraints pertaining to the allocation of security costs. They are a reasonable statement of the limitations of the methodology used to determine security requirements. Desmatics judges that these constraints do not restrict unduly the validity of the allocations made in this process.

WSSC documentation states that the accuracy of security cost data which the system displays may not adequately reflect the fact that units are sometimes required to provide security for other than their own aircraft. While this undoubtedly occurs, these expenses may be expected to balance out in the longer run on a servicewide or even a commandwide basis. A similar problem will occur if one command requires system security for an MDS while another does not require security for the same MDS. The effect will be that the worldwide display of costs for such an MDS will reflect the weighted average of security costs, which may be misleading as to the costs of guarding this aircraft. Separate displays, by command,

would perhaps be more meaningful, since one command's summary might then show no security costs, while another might show considerable security costs for the same MDS. This can presently be accomplished within the interrogation capability provided by WSSC.

WSSC documentation discusses the fact that the security costs for some aircraft, such as SAC U2's and SR71's, may be understated. This occurs because these aircraft are not reported to the data systems which WSSC uses as input. Such nonreporting also has the effect of overstating security costs for other security-requiring aircraft at the bases where they are located. Unfortunately, this problem cannot be corrected unless the missing data is reported.

An additional caveat mentioned in the WSSC manual is the assumption that security costs and strengths are proportional to the FY81 FH-PH ratio defined in the previous section. As pointed out in Volume I, this type of ratio produces inconsistent results. Even without this drawback, it is a matter of some conjecture whether security costs and strengths should be distributed based on numbers of aircraft and the amount of flying each does. It seems reasonable to use the number of aircraft (although this implies that every type of aircraft requires the same amount of security), but it is harder to see a relationship between security requirements and flying hours. If anything, one would expect aircraft to require security independent of or in inverse proportion to the amount of flying done. Based on this argument set forth by Desmatics, the Office of VAMOSC changed the allocation ratio for FY82 so that it is based entirely on possessed hours, eliminating the flying hour component. However, for FY81, these costs were allocated using both flying hours and possessed hours.

It may be noted that the security costs displayed by WSSC are entirely

labor costs. However, there are other types of costs reported in the ABDS system which are charged to system security. AF Regulation 170-5 shows that there is a Cost Center code of 435X (corresponding to the FAC code of 435X for system security personnel within the E300Z personnel system) which identifies system security costs within the files of the ABDS system. Most of these costs are for personnel pay and allowance, as indicated by appropriate EEIC's. However, there are also costs reported in ABDS with a CC code of 435X which have EEIC's indicating expenditures for materiel and other nonpay categories of expense.

Desmatics recommends that the Office of VAMOSC determine the nature of the nonpay costs for system security reported in ABDS. A judgement can then be made as to the desirability of providing separate visibility for those costs in the WSSC system. The costs can be allocated among security-requiring MDS's on the same basis as personnel costs.



## VI. POL

This section examines WSSC procedures for selecting POL costs and the algorithm used to allocate these costs to the command-base-MDS level. It reviews CAIG and WSSC definitions of included costs, the WSSC allocation algorithm, and the input data sources.

The CAIG guidelines [1] require that the "cost of aviation petroleum, oil and lubricants required for peacetime unit flying operations" be included in weapon system cost accounting. To be included are costs for POL consumed in-flight or on the ground with allowances for distribution, storage, evaporation and spillage. The WSSC User's Manual (AFR 400-31, Vol. II) [5] indicates that aviation fuel used for aircraft propulsion is reported in the unit operations portion of the AF Detail format, while oil and lubricants are reported in the material expense element for below depot maintenance cost centers. In the CAIG format aviation fuel is reported as POL under unit level consumption, while oil and lubricants are subsumed under the costs reported as maintenance materiel for unit level consumption.

### A. PROCESS DESCRIPTION

Input to WSSC for POL processing comes from D022A (the Centralized Fuels Management System) and G033B (the AVISURS system). D022A provides WSSC with worldwide annual fuel costs totaled for each MDS. Costs are included for all commands, not just the relevant commands. These worldwide costs are allocated down to the relevant command-base-MDS level by means of a two-step procedure that uses flying hour data from G033B. (Note: The WSSC User's Manual reports this algorithm as a one-step procedure.

The two-step process described in the WSSC Subsystem specification manual [3], is reviewed here.)

The first allocation step factors relevant command costs for an MDS out of the worldwide costs using an allocation ratio as follows:

$$\frac{\text{FH (relevant CMD's/MDS)}}{\text{FH (all CMD's/MDS)}} \cdot$$

Worldwide costs for the given MDS are then multiplied by this ratio to obtain relevant command level costs for this MDS.

The second step uses a different allocation ratio to break these costs down to the relevant command-base level. This ratio is defined as:

$$\frac{\text{FH (relevant CMD/GELOC/MDS)}}{\text{FH (relevant CMD's/MDS)}} \cdot$$

This ratio, multiplied by the costs computed in the first step, yields the costs for POL for a given MDS at each relevant command-base combination. It should be noted that in the case of POL as it is currently defined, it would be possible to collapse the two steps into one without encountering the problems noted in Section IV of Volume I because the ratios use only flying hours. A unified ratio would be defined as is shown in the WSSC User's Manual:

$$\frac{\text{FH (relevant CMD/GELOC/MDS)}}{\text{FH (all CMD's/MDS)}} \cdot$$

#### B. QUALITATIVE EVALUATION

Aside from the possibility of streamlining processing by using a one-stage allocation procedure, the allocation of D022A POL costs by WSSC is conceptually sound. It is based on the assumption that bases that fly the greatest share of the hours for an MDS should bear the greatest share of

the fuel costs. This is a reasonable assumption in that the fuel used for ground testing or maintenance is a negligible portion of all fuel used.

It should be noted that by obtaining fuel costs from D022A at the worldwide MDS level and allocating down to base level, WSSC obscures true base-to-base differences in consumption rates. Inevitably, there are base differences due to climate, policy and mission which are masked by this method of allocation. A superior representation would result if consumption data at the CMD/GELOC/MDS level could be provided.

There is, however, a further aspect of POL processing that should be examined relating to the handling of costs for oil and lubricants. The WSSC User's Manual [5] notes that D022A does not include most oil and lubricant costs; these costs are imbedded in the base level materiel expenses. It can be inferred from the CAIG definition of POL that it would be better to include oil and lubricant costs under POL than under maintenance material. A method is then needed to identify these costs in ABDS data and allocate them to the CMD/GELOC/MDS level.

Within below depot maintenance cost centers, materiel costs are represented in the ABDS input as records with EEIC's of 60XXX-63XXX. WSSC identifies a subset of these (EEIC 601XX, 602XX and 603XX) as pertaining to POL costs. These EEIC's correspond to aviation POL, packaged oil and lubricants, and missile propellants respectively.

EEIC 601XX costs are defined in EL-191 of AFM 300-4 [7] as Form-15 issues of Aviation POL which apply only to OAC 33 (AF/ACBO). Examination of MAC and TAC FY81 ABDS data confirms that this EEIC is not used by these commands. Therefore, it is not a useful source of POL costs and should be excluded from WSSC processing.

EEIC 602XX costs are defined in EL-191 as general support division

packaged aviation oils and lubricants. These records should be selected for inclusion along with D022A fuel costs and reported in unit operations POL costs (unit level consumption POL in the CAIG format).

EEIC 603XX costs are defined in EL-191 as fuels division issues of missile propellants. Included here are costs for de-icing fluids, methanol, helium, breathing oxygen, liquid nitrogen, descaling compound and calibrating fluid. These materials are not strictly for use on missiles and are appropriate to include in WSSC processing similar in manner to EEIC 602XX records when they are combined with a below depot maintenance CC code.

Further examination of EL-191 suggests that EEIC 693XX be considered for inclusion with POL costs. This EEIC is used for costs of aviation POL other than for flying requirements, such as engine block tests. A look at MAC and TAC FY81 records shows that this EEIC is used with a variety of CC codes. Desmatics recommends that records with a below depot maintenance CC code be included in WSSC POL processing similar to EEIC's 602XX and 603XX.

Unlike D022A data, these ABDS records represent costs incurred at the command-base level and do not have an MDS identification. As they are currently treated in the below depot maintenance process, they are allocated to MDS's on the basis of a count of maintenance man-hours for defined work centers at the command-base-MDS level using input from the D056 system. This assumes that maintenance material consumption (including oil and lubricants) is directly proportional to the time spent on maintenance. This relationship in general is questionable and is discussed further in Volume IV of this report series. For the specific case being considered here, it is recommended that the MDS allocation be made on the basis of flying hours. That is, Desmatics suggests that an allocation

ratio be defined as follows and that this ratio be applied to ABDS records having EEIC's of 602XX, 603XX and 693XX. Since ABDS costs are reported for each relevant command-base combination, the appropriate ratio would be defined as:

$$\frac{FH (CMD/GELOC/MDS)}{FH (CMD/GELOC)} .$$

Of the available data it would seem that flying hours relate best to the need for oil and lubricants. As flying hours increase, weapon system needs for oils and lubricants increase as a result of the wear placed on the weapon system's components. Maintenance man-hours, on the other hand, increase with the complexity or extent of repairs required for an MDS. This may be more related to the age of the weapon system or the relative sophistication of its design.

Desmatics also looked at the usefulness of the AVFUEL Management Accounting System as an alternative input source to D022A. This system is currently under development. Like D022A, it includes only fuel costs. If, however, examination of the output of this system as it evolves shows that the data would be in a more amenable format for WSSC or that there is a greater level of detail, then a cost-benefit study should be made to determine whether or not to change input sources.

Both the D022A and AVFUEL system collect aviation fuel quantity data as well as cost, but WSSC does not currently display fuel consumption in terms of gallons. Such information would be of considerable value for making fuel consumption comparisons independent of market prices at particular places and times. CAIG has indicated its interest in having this type of visibility, and Office of VAMOSC personnel are aware of both the desirability and feasibility of displaying gallon usage data. It is recommended that this objective be pursued.

## VII. TRAINING MUNITIONS

WSSC displays the cost of munitions used in maintaining the combat readiness of aircrews for all relevant command aircraft which require munitions proficiency. Costs are based on the number of crews maintained for each type of aircraft, using a table of average estimated costs per crew. The munitions costs depicted by WSSC represent peacetime requirements for regular aircrew proficiency sustainment, in accordance with guidelines set forth by CAIG.

### A. PROCESS DESCRIPTION

WSSC uses personnel data from the E300Z system to identify aircraft crew members, by DAFSC, through a process described in Section I of this report. To determine the number of crews associated with a given MDS, the number of crew personnel for each authorized DAFSC is divided by the number required for one crew. Since the resulting numbers may vary from one DAFSC to another among the crew positions for an MDS, WSSC uses the smallest of these as the number of crews. Training munitions costs are then determined by applying cost-per-crew factors to the number of crews established for each CMD/GELOC/MDS.

### B. QUALITATIVE EVALUATION

As pointed out in the WSSC User's Manual, the procedure used to compute training munitions costs is subject to the constraint that the crew counting method minimizes the number of crews, which may result in

understating the costs, since partial crews are not counted. Of course, the crew count could be based on the DAFSC with the largest number of crew positions which could be manned, but this could just as easily result in an overstatement. A middle course of action would be to compute an average number of crews, but the improvement in accuracy might not be worth the additional effort. It therefore would appear that the present method represents a reasonable approach to the problem of determining training munitions costs in the absence of a direct source of data showing actual expenditures.

To a great extent, the accuracy of the training munitions costs portrayed in WSSC is dependent on the quality of the crew cost factors which are employed. The table shown in the current WSSC User's Manual contains a list of average costs for 21 MDS combinations. There is also a list of 11 exceptions, each of which differs quite considerably from the norm, suggesting that training munitions costs can be highly variable. The advantage in the use of such planning factors is that they provide a convenient way, in the absence of detailed source data, for representing conditions on the average. At the same time they fail to portray the inherent variability.

### VIII. CONCLUSIONS, RECOMMENDATIONS AND OFFICE OF VAMOSC COMMENTS

This volume has presented an evaluation by Desmatics of the WSSC cost allocation algorithms for unit operations. As part of this evaluation, Desmatics has made a number of suggestions for consideration by the Office of VAMOSC.

#### A. SUMMARY

The WSSC algorithms for unit operations costs provide, in general, an adequate portrayal of these costs. However, Desmatics has made a number of recommendations that should result in an improved WSSC system. Two of these recommendations have already been implemented by the Office of VAMOSC. One concerned unit life support personnel; the other addressed system security.

In the initial WSSC design, unit life support personnel and their associated costs were included under command staff, but centralized life support was considered to be "other unit personnel" cost. Following Desmatics' suggestions, the Office of VAMOSC moved centralized life support to the command staff category for FY82. This step provided improved visibility and greater consistency.

Aircraft system security costs are driven by the number of aircraft requiring security and are not affected by flying hours. Initially the WSSC allocation was based on both. Following Desmatics' recommendation, the Office of VAMOSC changed to the exclusive use of possessed hours for FY82 and beyond. This provides a more equitable basis for allocation.



## B. RECOMMENDATIONS AND REPLIES

This section lists Desmatics' conclusions and recommendations with respect to the WSSC algorithms for the unit operations costs addressed in this report. The responses provided by the Office of VAMOSC are also included.

### 1. Aircrew Identification and Costing

Conclusion: In view of the fact that crew costs cannot be distinguished from command staff in ABDS data, the WSSC approach is judged to represent a satisfactory solution to the problem of computing aircrew pay and allocating costs to the CMD/GELOC/MDS level.

Recommendation: The Office of VAMOSC should continue to use the current algorithm for computing and allocating aircrew costs.

Office of VAMOSC Comments: "Concur."

### 2. Excluding Higher Echelon Personnel Costs

Conclusion: In line with CAIG guidance, higher level personnel and their associated costs should not be included in WSSC command staff. Nonpersonnel costs can be identified in ABDS, based on the responsibility center codes, but personnel cannot be identified in the same way in MPC data because FAC codes have no equivalence to the RC code.

Recommendation: The Office of VAMOSC should consider excluding higher echelon costs, identified by RC code, from ADBS input to WSSC. Similarly, consideration should be given to excluding higher level personnel from MPC using PAS codes to omit certain specific organizations.

Office of VAMOSC Comments: "Concur. This effort will require a great deal of research to account for command unique methodologies. Because of the scope of this effort, it cannot be initiated until FY85 for implementation with FY87 input data in CY86."

### 3. Providing Specific Visibility for Command Staff Contract Costs

Conclusion: The current USAF Detail Report does not provide separate visibility for contract costs under command staff. They are included in "other."

Recommendation: The Office of VAMOSC should consider providing separate visibility of command staff contract costs.

Office of VAMOSC Comments: "Concur. If contract costs can be extracted by EEIC Air Force wide, this change will be submitted in FY84 for FY85 data processing."

### 4. Allocation of Command Staff and Other to the MDS Level

Conclusion: Command staff and other unit personnel costs are currently allocated to MDS's on the basis of flying operations ratios. This is one of the few allocations still using this basis of allocation.

Recommendation: The Office of VAMOSC should consider allocating these costs in proportion to the crew strengths associated with each MDS.

Office of VAMOSC Comments: "Concur. This change will be submitted in FY84 for FY85 processing."

### 5. MAC Associate Program

Conclusion: The associate program in MAC may have an impact on the costs and maintenance manhours reported against MAC aircraft.

Recommendation: The Office of VAMOSC should investigate how the associate program data is reflected in the accounting, manpower and maintenance manhour systems to determine whether changes to WSSC are required.

Office of VAMOSC Comments: "Concur. The Office of VAMOSC has been precluded by resource constraints from dealing with the Air Reserve Forces costs. It is anticipated this ceiling will be lifted in FY84 and research can begin into this area."

## 6. Nonpay Security Costs

Conclusion: There are materiel costs under RC/CC XX435X which are not currently included under system security.

Recommendation: The Office of VAMOSC should consider including these costs in WSSC reporting.

Office of VAMOSC Comments: "Concur. This change will be submitted in FY84 for FY85 processing."

## 7. Oil and Lubricant Costs

Conclusion: Oil and lubricant costs are not included in the D022A input. ABDS contains such costs under EEIC 602, 603 and 693, but WSSC currently treats these as part of the materiel costs within aircraft maintenance units.

Recommendation: The Office of VAMOSC should consider removing these oil and lubricant costs from below depot maintenance and displaying them as unit POL consumption.

Office of VAMOSC Comments: "Concur in part. The discrete reporting of these costs is indeed a desirable item. However, 602, 603 and 693 costs within the maintenance complex report not only aircraft oils and lubricants, but those for all support equipment as well. Until an improved methodology for segregating these costs exists, they must continue to be shown as part of materiel costs."

## 8. POL Quantity Visibility

Conclusion: As suggested by CAIG, it would be useful if WSSC could provide visibility of the quantity of fuel used for aircraft propulsion.

Recommendation: The Office of VAMOSC should continue its attempt to obtain gallons-consumed data for aircraft propulsion fuels.

Office of VAMOSC Comments: "Concur. Based upon the decision concerning use of the newer AVFUELS Management Accounting System, this recommendation will be implemented within 24 months."

## 9. Training Munitions Costs

Conclusion: The use of cost per crew factors and counts of crews based on the AFSC with the smallest number of personnel is not the optimum method of determining these costs and at best obscures local variations.

Recommendation: The Office of VAMOSC should attempt to find a direct source of base-level actual munitions consumption data.

Office of VAMOSC Comments: "Concur. It is anticipated that the Standard Base Supply System data will be analyzed and approved for use during FY84. A change will be submitted for FY86 implementation."

## IX. REFERENCES

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